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Metric Conversion: MAP and PLAN SCALES, RATIOS and PAPER SIZES



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Metric Conversion: MAP and PLAN SCALES, RATIOS and PAPER SIZES

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FORWARD

The terms of reference for the Interministerial Committee on National Standards and Specifications established by Management Board on July 22, 1970, include: "to draw up, in view of proposed Federal action, plans for the Government of Ontario's own conversion to a metric system and to advise Ministries and Management Board thereon".

To this end subcommittees were formed dealing with Education, Industry, Paper, Municipalities, Legislation and so on. This report is that of a subcommittee whose mission was "to study the problems of metric conversion and international paper sizes with reference to map and plan scales and ratios".

The report was presented to the Interministerial Committee on June 14, 1973 and was approved.

The report and its recommendation has wide application in facilitating ultimate metric conversion and may now be implemented by individual Ministries and Agencies on a voluntary basis. In addition the findings may be of value to metric conversion in the Private Sector. This report, in whole or part, may be reproduced with acknowledgement.

1. INTRODUCTION

Some Ontario Government Ministries and Agencies draw many maps and plans themselves (or have others do so on their behalf) as an essential part of their job of recording land topography, ownership and use; delineating natural resources; planning and designing new buildings, other structures and facilities; and when specifying new machinery and equipment of every type.

Others do not prepare their own maps and plans to any extent but simply make use of those available from other sources for such purposes as registration and assessment of land and property, approval of a wide variety of schemes and proposals, incorporation in documents and reports, fitting new furniture into old offices and a thousand-and-one day-to-day matters.

No matter how they get the map or plan they need, and what they use it for, all Ministries have a common interest in ensuring that maps and plans convey legibly, comprehensively and conveniently the information they are intended to transmit. Maps and plans must be uncluttered and have easy-to-read dimensions and/or simple provision to scale off measurements, as needed. They must also be of a suitable physical size to carry the required information, yet be easy to handle in the office and the field, to copy as needed and for storage in plan chests, file drawers or on microfilm.

Over many years, these requirements have led cartographers, land surveyors, engineers, architects, lawyers, indeed, most professionals and their associated drafting, office and reprographic services, to select sizes of paper and scales for maps and plans most convenient for their own particular use of displaying some ratio of inches, feet, yards and miles representative of the real thing.

2. PROBLEMS POSED BY PRESENT PRACTICE IN RELATION TO METRIC CONVERSION

Conversion to the metric system in Canada is impending. When this occurs, scales presently in common use such as 1" = 40' (1: 480) or 1/8" = 1' (1: 96) will lose any rational basis for their existence and would be very bothersome to use to display measurements in millimetres, centimetres, metres or kilometres, which fall into a ten rather than a twelve series of multiples. Similarly, with the size of drawing paper, sheets or rolls to inch sizes would eventually become special-order items that would not readily match new reproduction or printing equipment, or fit into files or report covers.

Changes, both with respect to the scales and sizes of maps and plans, will therefore eventually have to be made in Canada. The maps and plans prepared today for use by the Ontario Government will be used for many years to come. Some, such as basic maps and land plans, become permanent records and resources material for the future. The original plans for new structures or equipment will be referred to whenever maintenance or modification is needed in the metric years to come. Some schemes on the drawing board now may only reach fruition after industry has become metric. It is, therefore, very desirable that inch-feet plans be drawn from now on to scales and ratios and on paper size compatible with ultimate use of the metric system. This will facilitate both continued use of existing inch-feet plans for as long as is necessary and rational metric conversion.

3. SUBCOMMITTEE RECOMMENDATION

The subcommittee on map scales and ratios has devised, as shown in Table 1, a comparatively simple procedure to achieve the above objectives. A new series of ratios (dimensionless scales) is recommended, for use as soon as practical on all maps

and plans. In order to read from pre-metric plans provision is made for appropriate inch-feet ratio measuring scales. The same ratios will serve for future metric plans with the use of a set of metric ratio measuring scales. Because of the common ratios, both inch-feet and metric plans can in the future be scaled off in either inch-feet or metric units with equal facility by using the appropriate set of scales. One example set of these measuring scales is shown in Figure 1.

Alternatively, by photographic reduction or enlargement, using simple conversion factors, an inch-feet map or plan drawn to those present scales to be tolerated for continuing use can be converted to read in metric units at the new ratios.

Changes to ISO "A" paper sizes for all maps and plans, as shown in Table 2 and as folded in Figure 2 is also recommended as soon as practical.

3.1 Voluntary Compliance While Inch-Feet System is Still in Use

It is recommended that each Ministry be advised that adoption of the new preferred ratios and paper sizes for their maps and plans is strongly urged. However, as long as the inch-feet system is in use, there should be no compulsion to change if this is seriously disadvantageous to their present operations. It is the opinion of the subcommittee that most Ministries will wish to make the recommended changes as soon as these can be phased in.

3.2 Constraints on Compulsion

Voluntary adoption of the recommendations is suggested because of a number of problem areas that only individual Ministries can solve within their own operations and budgets. These include:

- (1) The cost of providing new drafting equipment, such as scales (relatively cheap) and curve templates (more expensive).
- (2) The cost and timing of conversion of printing and reproduction equipment.
- (3) Provision of new plan chests and filing cabinets as required.
- (4) Compatibility in size of "A" paper size maps and plans with those presently in use where both will for some time be needed together on the same project.
- (5) Filing of "A" - size plans for land registry purposes and compatibility with connected legal-size documents. (This problem appears less real than many

think, since by simple folding of "A" - size plans they will fit into existing file storage).

4. THE SPECIFIC RECOMMENDATIONS AND RATIONAL FOR THE PROPOSED PREFERRED MAP AND PLAN RATIOS AND PAPER SIZES IS AS FOLLOWS:

4.1 Map and Plan Scales and Ratios

The subcommittee has concluded as follows:

- (a) The ISO preferred series 1, 2, 5, 10, should be the series ultimately used for map and plan scales and ratios. However, because existing, and to some extent, future, needs are met by including certain maverick ratios at half the preceding one, a series of ratios that are presently preferred for use in both inch-feet and metric systems of measurement has been developed.

The series proposed are rational and should provide a sufficient range of choice for most circumstances. Intermediate ratios, not shown, may be required for special purposes but, before such a selection is made, it would be wise to consider that this would complicate drafting, scaling-off and interchangeability of maps and plans.

Table I displays in order of decision-making and relative accuracy, density and content of the information that can be presented, the scales and ratios which are used, may be used or should be used, on the whole range of maps and plans of concern to the Ontario government.

The column, "Presently Preferred (Scales and Ratios) for use in both inch-feet and metric system", is recommended for adoption as soon as practical. These ratios are compared to the right with those presently in common use for the general purposes shown together with conversion factors.

- (b) It should be noted that no direct equivalents are provided for certain commonly used scales, such as $3/16" = 1'$ (1: 64) or $3/8" = 1'$ (1: 32). Such scales fall awkwardly into the new preferred series and would require conversion factors of + 28% and - 36% respectively to match a 1:50 ratio. All the preferred scales shown for tolerated continuing use fit the new preferred ratios by a simple conversion of -4% or + 20%. When phasing out these present awkward scales a replacement from the new preferred series (not from amongst the tolerated scales) should be selected wherever possible.

Provided, then, that only those of the present scales in common use which are shown as tolerable for continuing use in Table 1 and which have the same conversion factor are used on an inch-feet drawn map

Table 1, Map and Plan Scales and Ratios Recommended for Use by Ontario Government

ISO RATIONAL RATIOS FOR ULTIMATE METRIC USE	DEVELOPED, PREFERRED AND TOLERATED SCALES AND RATIOS FOR USE IN IMMEDIATE FUTURE			PRESENTLY USED SCALES AND RATIOS TO BE PHASED OUT*
	PRESENTLY PREFERRED FOR USE IN BOTH INCH-FEET AND METRIC SYSTEM	CONVERSION FACTORS	FOR TOLERATED CONTINUING USE WHERE NECESSARY IN INCH-FEET SYSTEM	
1:1 000 000	1:1 000 000	PHYSICAL CONVERSION NOT CONTEMPLATED IN FORSEEABLE FUTURE DUE TO COST, ETC. SPECIALIZED MAPS WILL REMAIN IN USE. FOR NON-SPECIALIZED USE, NTS SERIES AVAILABLE	1" = 25 MILES (1:1 584 000) ALL ONTARIO ON 1 SHEET MINERAL MAP	
1:500 000	1:500 000		1" = 16 MILES (1:1 013 760) INDEX MAPS ONTARIO IN 5 SHEETS IN ATLAS FORM, FOR MINERAL AND GEOLOGICAL MAPS	
1:200 000	1:250 000		1" = 8 MILES (1:506 880) ONTARIO TERRITORIAL SERIES	
			1" = 4 MILES (1:253 440) ONTARIO COUNTY AND ADMINISTRATIVE BOUNDARY MAPS, GEOLOGICAL COMPILATION MAPS	
1:100 000	1:125 000		1" = 2 MILES (1:126 720) ONTARIO PROVINCIAL TOPOGRAPHIC SERIES, NORTHERN ONTARIO DISTRICTS	
1:50 000	1:50 000		1" = 1 MILE (1:63 360) INDUSTRIAL MINERAL AND GEOLOGICAL MAPS, SOUTHERN AND CENTRAL ONTARIO. TOWNSHIP MAPS, SOUTHERN ONTARIO	
1:20 000	1:25 000		1" = ½ MILE (1:31 680) CADASTRAL TOWNSHIP PLANS OF SURFACE AND SUB-SURFACE RIGHTS	
			1" = ¼ MILE (1:15 840) FOREST RESOURCES INVENTORY, SOUTHERN AND CENTRAL ONTARIO	
1:10 000	1:10 000		1" = 1000' (1:12 000) GEOLOGICAL MAPS, MAJOR MINING CAMPS	

1:5000	1:5000 1:2500		-4% 0%	1" = 400' (1:4800) 1" = 208.33' (1:2500)	LOCATION AND BLOCK PLANS	ALL SCALES AND RATIOS NOT SHOWN IN COLUMN IMMEDIATELY TO LEFT SPECIFICALLY INCLUDING:
1:2000	1:2000 1:1250		-4% +20%	1" = 200' (1:2400) 1" = 200' (1:2400)		
1:1000	1:1000		0% -4% +20%	1" = 104.17' (1:1250) 1" = 100' (1:1200) 1" = 100' (1:1200)		
1:500	1:500		-4%	1" = 40' (1:480)		
1:200	1:200		-4%	1/16" = 1' (1:192)	SITE PLANS	1" = 20' (1:240) 1" = 10' (1:120)
1:100	1:100		-4%	1/8" = 1' (1:96)		3/16" = 1' (1:64)
1:50	1:50		-4%	1/4" = 1' (1:48)	DETAILED DRAWINGS OF LAYOUTS, COMPONENTS AND ASSEMBLIES FOR BUILDINGS OTHER STRUCTURES AND FACILITIES, MACHINERY AND EQUIPMENT	3/8" = 1' (1:32) 3/4" = 1' (1:16)
1:20	1:20		+20%	1/2" = 1' (1:24)		
1:10	1:10		+20% -20%	1" = 1' (1:12) 1 1/2" = 1' (1:8)		
1:5	1:5		-20%	3" = 1' (1:4)		
1:2	1:2		0%	HALF SIZE (1:2)		
FULL SIZE	FULL SIZE		0%	FULL SIZE		SHOULD BE PHASED OUT AS SOON AS POSSIBLE TO FACILITATE METRIC CONVERSION

* Note: Wherever possible, switch directly to appropriate ratio scale in either of two extreme left-hand columns.

or plan, the option then exists of converting any inch-feet map or plan to a metric map or plan by simple photographic enlargement or reduction and the direct use of the appropriate metric measuring scale.

(c) Figure 1 provides examples of prototype ratio measuring scales which would be furnished to read off maps and plans drawn to the new presently preferred ratios in either inch-feet or metric units of measurement. Depending on the quantity required and the quality, the unit cost of each measuring scale would be between 14 cents and \$1.25. They are commercially available from Ontario manufacturers and could be furnished through Ministry of Government Services.

For certain uses, for example in highway layout work, curved templates are required. Templates to suit the new ratios have been laid out by MTC for highway work and a source of supply is available. It is suggested that other Ministries needing curved templates contact MTC for further information.

(d) As far as can be seen ahead, maps and plans will be co-existing side by side, some drawn in inch-feet, some in metric measure, to a variety of scales and ratios, which may or may not be interchangeable. This confusion must be minimized lest the ultimate user falls into the trap of taking off erroneous distance or dimension through using the wrong measuring scale. It is recommended strongly that "warning flags" be prominently displayed on all maps and plans (graphic scales alone, printed on the map or plan, will not suffice, since future scaling off may be in different units or ratios).

Three possible conditions may exist for which warning is necessary:

- (i) **DRAWN IN INCH-FEET UNITS AT 1: x RATIO** (inch-feet ratio or metric ratio measuring scale can be used).
- (ii) **DRAWN IN INCH-FEET UNITS AT 1" = x' SCALE** (inch-feet measuring scale only can be used unless drawing is enlarged (or reduced) y % to 1: z ratio so that inch-feet ratio or metric ratio measuring scale can be used).

Note: when such enlargement (or reduction) has been made on the original or for any copies, each of these should be prominently over stamped: - **THIS DRAWING HAS BEEN CONVERTED TO 1: z RATIO SCALE.**

- (iii) **DRAWN IN METRIC UNITS AT 1: z**

RATIO (metric ratio or inch-feet ratio measuring scale can be used).

(e) The new preferred scales are generally so close to the present ones that no significant changes in drafting practice, lettering size and the like, appears necessary as a consequence of change. It should be kept in mind that for those drawings that continue to be produced to tolerate inch-feet scales which may eventually require reduction by 20% ($1\frac{1}{2}" = 1'$) and $3" = 1'$) that letter size and legibility will suffer somewhat when this is done.

(f) Again, where drafting of plans continues in inch-feet units using tolerated scales ($1" = 200'$), ($1" = 100'$), ($\frac{1}{2}" = 1'$) that may ultimately require enlargement by 20% to furnish plans to preferred ratio scales, the effect of blowing up the plan must be kept in mind. Upon enlargement, it will still have to fit an "A" series size piece of paper. Twenty percent of the original area available for the plan has therefore to be wasted.

(g) Overall Conclusion

The Presently Preferred Scales and Ratios shown in Table I should be introduced in the drafting of all maps and plans as rapidly as possible. While use of certain existing scales can be tolerated, there are many advantages in actively discouraging their use as soon as possible.

4.2 Map and Plan Paper Sizes

The subcommittee on paper is recommending adoption of ISO "A" series of paper sizes for all general purposes. Because the most appropriate size of map or plan is dependent on the scale to which it is drawn in relation to information that has to be portrayed, this subcommittee was instructed to specifically consider paper sizes for maps and plans.

The subcommittee reviewed both the "A" series and the "B" series (the latter being available by ISO standard for special purpose where sizes intermediate in the "A" series are essential) and had prepared for its viewing sample plans drawn to both the presently used scales, for example $1" = 200'$, and to the proposed ultimate ratio scale (1: 2000) and the preferred present ratio (1: 2500) within the confines of presently using drawing size, $36" \times 22"$, and its equivalent AI size ($33 \frac{1}{8}" \times 23 \frac{3}{8}"$). The subcommittee concluded that:

- (a) While certain of the "B" paper sizes fitted present drafting practice somewhat better than did the "A" series, the "A" series, taking the long range view of metrication and the need to match other documents, was adequate for all normal maps and plans. Certain exceptional uses of "B" series for special documents may be necessary. If so, this,

though to be discouraged, can be left to the choice of each Ministry.

- (b) The appropriate "A" - size map or plan was in no way inferior for displaying the required information legibly when using the new preferred ratio scales.
- (c) Any initial intuitive reluctance to change to "A" series would quickly disappear once persons became familiar with the new sizes.
- (d) Each Ministry would select from the "A" series the appropriate paper sizes to be used for the particular maps and plans to suit its own operation. Table 2 provides guidance as to available trimmed sizes.
- (e) Figure 2 taken from BS.1192 indicates methods of folding "A" - size maps and plans and is for tentative use pending establishment of a Canadian standard (Note: provision for edge binding may be required in some applications).
- (f) Introduction of "A" - size drawing paper (and plastic bases) within individual Ministries should be made at the earliest possible date, depending on the availability of supporting equipment, such as that for printing and reproduction or storage. Present manual drafting tables and machines will accommodate working on "A" - size paper.
- (g) The "A" (and "B") series of paper sizes present great advantages in case of enlargement or reduction and promise attendant economies over present practice.
- (h) There may be initial problems where "A" - size plans have to match other documents or filing

systems, or where individual Ministries have developed practices of compiling, say, contract documents, from half-size reduction of original plans.

The strongest concern was in the legal area, where, for land registry purposes and so on, deeds and plans are "legal" size. After much discussion, it was determined that "A" - size plans, when folded down to A4 if necessary, would fit, "legal" size requirements should these continue to be legal (which appears to be up in the air). Otherwise, of course, folded "A" series plans will match all other paper documents.

(i) Overall Conclusion

"A" series size paper and base films should be introduced into the drafting of maps and plans as rapidly as possible.

5. FUTURE IMPLICATIONS

There are varying degrees of unilateral action in the subcommittee's recommendations as to map and plan ratios and sizes that should be used by the Government of Ontario. This is due to the leadership being provided by Ontario in metrication.

In determining its recommendations the subcommittee has made a review of many documents obtained from Britain and the U.S. and elsewhere, relating to their practices with maps and plans and accomplished or contemplated metric conversion. These documents all contain a common thread of both standardising on ratios, preferably in 1, 2, 5, 10, series (using other series only when expediency necessitates) and using "A" series of paper sizes. It is therefore considered highly unlikely that the Federal level in Canada or from other sources irretrievable

Table 2 - Trimmed Sizes of Drawing Sheets

REFERENCE	SIZE	APPROXIMATE INCH EQUIVALENTS
	mm	in.
A 0	841 X 1189	33 1/8 X 46 3/4
A 1	594 X 841	23 3/8 X 33 1/8
A 2	420 X 594	16 1/2 X 23 3/8
A 3	297 X 420	11 5/8 X 16 1/2
A 4	210 X 297	8 1/4 X 11 5/8

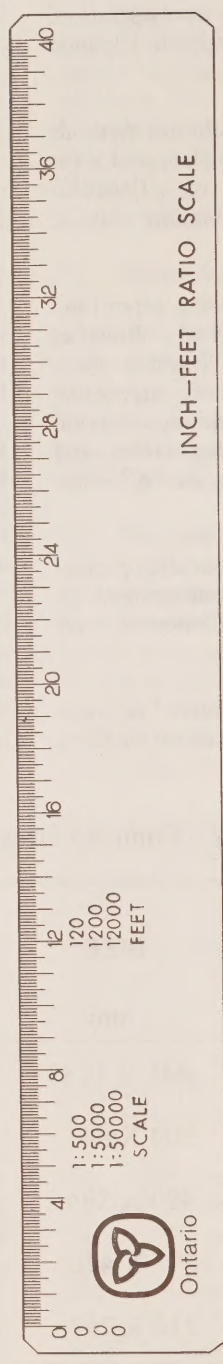
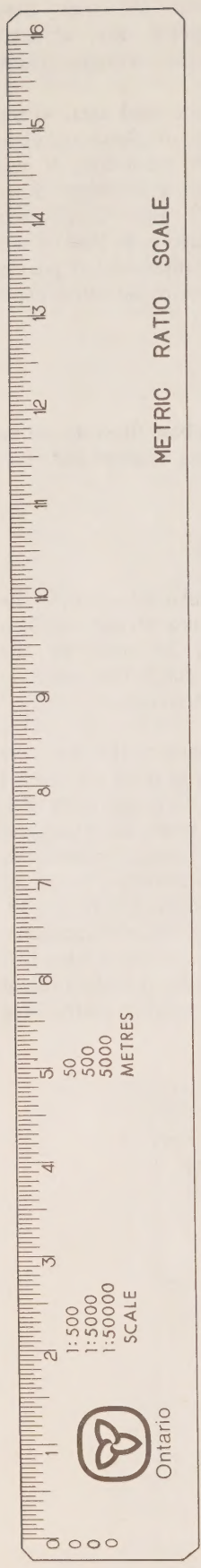


FIG.1, SAMPLE RATIO SCALES — INCH-FEET & METRIC
(NOTE: REDUCED SCALE)

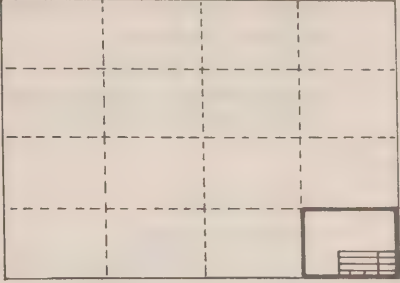
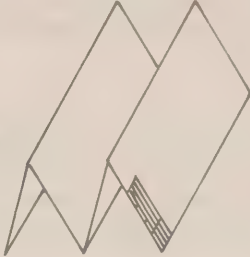







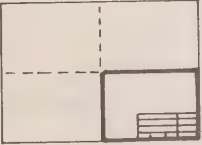





SHEET SIZE mm	FOLD LINES	INTERMEDIATE	FINAL IS A4 210 × 297
A0 841 × 1189			
A1 594 × 841			
A2 420 × 594			
A2 420 × 594			
A3 297 × 420			

FIG.2, SIMPLE FOLDING OF DRAWINGS

conflict with the Ontario proposal will develop, though later on minor conflicts may arise.

Such minor conflicts are to be expected throughout the whole spectrum of metric conversion and are not sufficient reason for not moving ahead whenever and wherever this can be done.

The subcommittee has not gone into the details of metric conversion as it will apply to the information to be recorded on maps and plans. For example, what should the contour interval be on metric maps? Should both metric and British units be shown on the same plan? These matters remain to be studied by others at a later date.

The proposed system provides the ground rules, the basic tools, on which all future actions relating to maps and plans during metric conversion can proceed. By early implementation, even though British units are still used on the maps and plans, much accumulation of deadwood maps and plans that may require costly redrafting later on will be avoided.

Furthermore, staff will have one less thing to worry about when their prime concern is using unfamiliar metric units of length as conversion takes over on the maps and plans they prepare or use. The spinoff from early implementation of these proposals by the Government will be of considerable value to Ontario industry in preparing themselves for metric conversion.

6. APPROVAL

This report, after its basic contents were arrived at in subcommittee meetings, was circulated to members of the subcommittee shown in Appendix A for technical approval. Subsequently, the draft report was circulated to all Ministries and Agencies represented on the Interministerial Committee. Comments received, as a result, have been incorporated wherever possible in this final report to the satisfaction of the proposer.

The report and its recommendations now stand for implementation by individual Ministries and Agencies on a voluntary basis in order to facilitate ultimate metric conversion.

APPENDIX A - Members of Subcommittee on Map and Plan Scales Ratios and Paper Sizes

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